Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

1   1.   (Currently Amended)   A method for controlling a gap in an
2 electrically conducting solid state structure, comprising the steps of:
3   providing an electrically conducting solid state structure including a
4 gap in the structure;
5   exposing the structure to a fabrication process environment conditions
6 of which are selected to alter an extent of the gap in the structure;
7   applying a voltage bias across the gap in the structure during process
8 environment exposure of the structure;
9   measuring electron tunneling current across the gap during process
10 environment exposure of the structure to indicate an extent of the gap; and
11   controlling the process environment during process environment
12 exposure of the structure, based on the tunneling current measurement, to
13 control an extent of the gap.

1   2.   (Original)   The method of claim 1 wherein controlling the
2 process environment comprises halting process environment exposure of the
3 structure based on tunneling current measurement.

1   3.   (Original)   The method of claim 1 wherein controlling the
2 process environment comprises comparing tunneling current measurement
3 with a threshold tunneling current corresponding to a prespecified gap extent
4 and controlling the process environment based on the comparison.

4. (Original)   The method of claim 1 wherein the conditions of the fabrication process environment are selected to increase an extent of the gap in the structure.

5. (Original)   The method of claim 1 wherein the conditions of the fabrication process environment are selected to decrease an extent of the gap in the structure.

6. (Original)   The method of claim 1 wherein the fabrication process environment comprises ion beam exposure of the structure.

7. (Original)   The method of claim 6 wherein the ion beam exposure comprises blanket ion beam exposure of the structure.

8. (Original)   The method of claim 6 wherein the ion beam exposure comprises rastering of the structure by a focused ion beam.

9. (Currently Amended)   The method of claim 1 wherein the structure comprises two electrically conducting electrodes having the a gap between the electrodes.

10. (Original)   The method of claim 9 wherein the electrically conducting electrodes are disposed on an electrically insulating membrane including an aperture aligned with the gap between the electrodes.

11. (Original)   The method of claim 9 wherein the electrically conducting electrodes are disposed on an electrically insulating surface of a substrate.

12. (Canceled)

13. (Canceled)

14. (Canceled)

15. (Canceled)

16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Canceled)

20. (Canceled)

21. (Canceled)

1   22.   (Previously Presented)   The method of claim 1 wherein the

2 fabrication process environment comprises electron beam exposure of the

3 structure.

1   23.   (Previously Presented)   The method of claim 9 wherein each

2 electrically conducting electrode is connected in a closed-loop circuit across the

3 gap for measuring electron tunneling across the gap.

1   24.   (Previously Presented)   The method of claim 9 wherein each

2 electrically conducting electrode is disposed in a connection to an electrical

3 contact pad.

1   25.   (Previously Presented)   The method of claim 24 wherein applying

2 a voltage bias across the gap in the structure comprises applying a voltage bias

3 between the electrical contact pads.

1   26.   (Previously Presented)   The method of claim 1 wherein providing

2   an electrically conducting solid state structure including a gap in the structure

3   comprises:

4   first providing an electrically conducting solid state structure without a

5   gap; and

6   initiating the fabrication process environment to provide a gap in the solid

7   state structure.

1   27.   (Previously Presented)   The method of claim 1 wherein providing

2   an electrically conducting solid state structure including a gap in the structure

3   comprises:

4   first providing an electrically conducting solid state structure without a

5   gap; and

6   initiating a fabrication process environment to provide a gap in the solid

7   state structure that defines two electrically conducting electrodes separated from

8   each other by the gap.

1   28.   (Previously Presented)   The method of claim 27 wherein the

2   exposure of the structure to fabrication process environment increases the extent

3   of the gap between the two electrically conducting electrodes.

1   29.   (Previously Presented)   The method of claim 10 wherein the

2   electrically insulating membrane comprises a silicon nitride membrane.

1   30.   (Previously Presented)   The method of claim 11 wherein the

2   substrate comprises a silicon substrate.

1   31.   (Previously Presented)   The method of claim 1 wherein measuring

2   electron tunneling current comprises amplifying acquired electron tunneling

3   current prior to measuring electron tunneling current.

1   32.   (Previously Presented)   The method of claim 1 wherein measuring

2   electron tunneling current comprises digitizing acquired electron tunneling

3   current prior to measuring electron tunneling current.

1   33.   (Previously Presented)   The method of claim 1 wherein applying a

2   voltage bias across the gap comprises applying across the gap a voltage that is

3   less than a work function that is characteristic of the electrically conducting solid

4   state structure.

1   34.   (Currently Amended)   The method of claim 1 wherein controlling

2   the process environment based on tunneling current measurement comprises:

3   determining an extent of the gap, g, as a function of measured tunneling

4   current, I, and applied voltage bias, V, as:

5
$$I(V) = aV^2 e^{-b/v}$$

6   where $\qquad a = \dfrac{\sigma e^3}{16\pi^2 \phi h g^2}$ $\qquad$ and $\qquad b = \dfrac{4(2m_e)^{1/2} \phi^{3/2} g}{3he}$

7   and where σ is an area of the solid state structure at opposite sides of the gap, e

8   is the elementary charge, 1.6×10^{-19} C; $h = 1.1 \times 10^{-34}$ J·s; $m_e = 9.1 \times 10^{-31}$ Kg; and

9   ϕ is a work function of the solid state structure at the gap; and

10   controlling the process environment based on the determined gap.

1   35.   (Currently Amended)   The method of claim 1 wherein controlling

2   the process environment based on tunneling current measurement comprises:

3   determining <u>an extent of </u>the gap, g, as a function of measured tunneling

4   current, I, and applied voltage bias, V, as:

5 $$I(V) = I_0 e^{-\alpha\sqrt{\phi}g}$$

6   where $\qquad I_0 = \dfrac{\sigma e^2}{4\pi^2 h^2} \dfrac{\sqrt{2m_e\phi}}{g} V \qquad$ and $\qquad \alpha = \dfrac{2\sqrt{2m_e}}{h}$

7   and where σ is an area of the solid state structure at opposite sides of the gap, e

8   is the elementary charge, 1.6×10^{-19} C; $h = 1.1 \times 10^{-34}$ J·s; $m_e = 9.1 \times 10^{-31}$ Kg; and

9   ϕ is a work function of the solid state structure at the gap; and

10   controlling the process environment based on the determined gap.